

**METHOD FOR TRANSPORTING DATA, A RELATED DATA
TRANSMITTING ELEMENT AND A DATA RECEIVING ELEMENT**

BACKGROUND OF THE INVENTION

Ans a 17 The present invention relates to a method as described in preamble of
5 claim 1 and claim 2, to a related data transmitting device as described in
17 preamble of claim 3, to a related data receiving element as described in
preamble of claim 5 and claim 6 and the related software modules as described
in the preamble of claims 7, 9 and 10.

SUMMARY OF THE INVENTION

A Such a method and related network elements are generally known in
10 the art. A data transmitting network element sends data-packets towards a
destination through a communications network via an edge network element of
the communications network. In order to prevent from network congestion
caused by a data transmitting network elements transmitting data without taking
capacity-constraints and other possible constraints into account, a maximum
15 service level is negotiated between each of such data transmitting elements and
the edge element. Such a service level specification nowadays is negotiated
between both parties in a static way, for example by phone call or by e-mail.
There may be a policing means within the edge element to check if incoming
data-packet flows are in conformance with the agreed service level specification.
20 In case that the data transmitting network element at a certain moment of time
needs another service level, this should be renegotiated in the same static way.
Then the service level providing system should be updated to actually provide the
agreed service level. This is a very time-consuming and inefficient way of
negotiating service level specifications. Currently there is no automatic
25 negotiation and re-negotiation and the subsequent updating of the Service Level
Specification possible.

An object of the present invention is to provide a method of the above
known type but wherein the service level specification negotiation and at the
same time the adaptation is performed in a more efficient way.

According to the present invention, this object is achieved by the method as claimed in claims 1 and 2, the related elements as claimed in claim 3 and claims 5 and 6 and the related software modules as claimed in claims 7, 9 and 10.

5 Indeed, by negotiating a service level specification between a data transmitter and a data receiver and vice versa on both ends of a Point-to-Point connection, based on predetermined criteria, during the establishment of the Point-to-Point connection by sending Internet Protocol Control Protocol messages, a service level specification is agreed between both parties and this
10 service level specification is updated at the data receiving element. For this purpose there are new options defined for the Internet Protocol Control Protocol that forms part of the Point-to-Point Protocol, where this options contain service level specific parameters.

This negotiation can be initiated by the data transmitting element as in
15 claims 1, 5 and 7, or by the data receiving element as in claims 2, 6 and 10. In the latter case this is done by sending Internet Protocol Control Protocol messages to the data transmitting element if there are conditions that require the data receiving element to adapt the provided service level.

A further characteristic feature of the present invention is described in
20 claims 4 and 8. The received propose for a service level at the data transmitting element may be not satisfying in one or another way for the data transmitting element. If so the data transmitting element is able to notice this and to formulate another request for a service level that is sufficient for the data transmitting element. Re-negotiation of an existing service level specification is also possible
25 by sending Internet Protocol Control Protocol messages requesting another service level specification.

BRIEF DESCRIPTION OF THE DRAWINGS

30 The above and other objects and features of the invention will become more apparent and the invention itself will be best understood by referring to the following description of an embodiment taken in conjunction with the accompanying drawings wherein:

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Further there is a data receiving element DRE, that in this embodiment is chosen to be a network access server situated at the edge of the internet network INNW. This network access server provides the personal computer DTE access to the internet network INNW. Besides this, the network access server DRE

may take care of policing the data the personal computer DTE sends towards the network access server DRE.

The personal computer DTE is to be connected to the internet via a Point-to Point Protocol connection, further referred to as a PPP-connection.

5 The data transmitting element DTE as presented in FIG. 2 is built up of a data sending means DSM that takes care of sending data towards the data receiving element and a service level requesting means SL_R_M that is able to send a request to the data receiving element DRE for a predetermined service level for sending data, using an Internet Protocol Control Protocol request
10 message for this purpose. Further there is a service level propose receiving means SLP_R_M that is able to receive an Internet Protocol Control Protocol propose for the service level to be provided and subsequently to notify the data sending means DSM of the propose for the service level to be provided. The data transmitting element DTE also comprises a service level propose renegotiating
15 means SLP_RN_M that is able to check if a received Internet Protocol Control Protocol propose for a service level is satisfying and if not to formulate another request for a service level.

 The service level requesting means SL_R_M has an output-terminal that is at the same time an output-terminal O_1 of the data transmitting element
20 DTE. The data sending means DSM has an output-terminal that is at the same time an output-terminal O_2 of the data transmitting element DTE.

 Further, the service level propose receiving means SLP_R_M, has an input-terminal that is at the same time an input-terminal I_1 of the data transmitting element DTE and besides this an output-terminal that is coupled to
25 an input-terminal of the data sending means DSM. The service level propose renegotiating means SLP_RN_M is coupled between a second output-terminal of the service level propose receiving means SLP_R_M and an input-terminal of the service level requesting means SL_R_M.

 The data receiving element DRE as presented in FIG. 2 comprises a
30 receiving means DRM that is able to receive data from the data transmitting

element DTE. Further the data receiving element DRE contains service level request reception means SLR_Re_M that is adapted to receive a service level specification request from the data transmitting element DTE using an Internet Protocol Control Protocol message and a service level negotiating and proposing means SL_NP_M that is able to determine a service level specification based on at least one predetermined criterion and to formulate a propose for the service level specification. Then there is a service level proposal sending means SLP_S_M, that is adapted to send the propose for the service level specification using an Internet Protocol Control Protocol message.

10 ^{B'} The service level request reception means SLR_Re_M has an input-terminal that is at the same time an input-terminal I_2 of the data receiving element DRE and an output-terminal that is coupled to an input-terminal of the service level negotiating and proposing means SL_NP_M that in its turn is coupled with an output-terminal to an input-terminal of the service level request reception means SLR_Re_M. The service level proposal sending means SLP_S_M has an output-terminal that is at the same time an output-terminal O_3 of the data receiving element DRE. Then the data receiving means DRM contains an input-terminal that is at the same time an input-terminal I_3 of the data receiving element DRE.

20 In order to explain the operation of the present invention it is assumed that the personal computer DTE needs a specific quality of service that is specified in a service level specification. It is assumed that the personal computer DTE needs to establish a dial-in connection using the Point-to-Point Protocol. In a phase of this connection establishment, Internet Protocol Control messages, further referred to as IPCP-message are sent towards the network access server DRE to negotiate several connection-parameters, for example an Internet Protocol-address.

It is further to be noticed that all in the following mentioned IPCP-messages or requests are not the normally used messages or requests but a

modified message or request in that sense that each IPCP-message may contain additional options carrying service level specification negotiable parameters.

- In order to request a specific service level specification, the service level requesting means SL_R_M of the personal computer DTE sends an Internet Protocol Control Protocol request towards the network access server DRE for assigning another service level for sending data. The service level request reception means SLR_Re_M in its turn receives the Internet Protocol Control Protocol request for the service level from the data transmitting element DTE and forwards the request to the service level negotiating and proposing means SL_NP_M. The service level negotiating and proposing means SL_NP_M then determines a service level based on at least one predetermined criterion and subsequently formulates a propose for the service level to be provided. Such a criterion could be the current traffic on the outgoing links of the data receiving element DTE or a criterion available from a global network element like a policy server that can manage the entire internet network INNW.

- Subsequently the service level negotiating and proposing means SL_NP_M hands the propose over to the service level proposal sending means SLP_R_M that in its turn sends an Internet Protocol Control Protocol message that contains the relevant parameters of the propose for the service level to the service level propose receiving means SLP_R_M of the data transmitting element DTE which receives the Internet Protocol Control Protocol propose for the service level. The service level propose receiving means SLP_R_M notifies the data sending means DSM of the propose for the service level.

- The service level propose renegotiating means SLP_RN_M receives the forwarded service level propose from the service level propose receiving means SLP_R_M and subsequently checks if this Internet Protocol Control Protocol propose for the service level is satisfying. If not satisfying the service level propose renegotiating means SLP_RN_M formulates another request for the desired service level and forwards this towards the service level requesting means SL_R_M that in its turn further handles the request.

There may be a policing means (not shown in any of the figures) available within the data receiving element to determine if the data transmitting element sends data in compliance with the agreed service level.

It is to be remarked that the data receiving element DRE is also able to
5 initiate a service level specification negotiation or re-negotiation by sending an
unsolicited propose.

It is further to be remarked that the data transmitting element DTE and the data receiving element DRE in another embodiment may be implemented by two coupled routers.

10 Although the above embodiment of the invention has been described by means of functional blocks, their detailed realisation based on this functional description should be obvious for a person skilled in the art and is therefore not described.

While the principles of the invention have been described above in
15 connection with specific apparatus, it is to be clearly understood that this
description is made only by way of example and not as a limitation on the scope
of the invention, as defined in the appended claims.